Manila Grass for Lawns

CIRCULAR
No. 26

Federal Experiment Station in Puerto Rico
U. S. DEPARTMENT OF AGRICULTURE

FEDERAL EXPERIMENT STATION IN PUERTO RICO

MAYAGUEZ, PUERTO RICO

Administered by the Office of Experiment Stations
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Cover Photograph

Manila grass (*Zoysia matrella* (L.) Merr.) is one of the best lawn grasses for the Tropics. It also can be grown in the continental United States as far north as New England. The lawn shown here at the Federal Experiment Station in Puerto Rico was planted 3 years before the picture was taken.

[1] In cooperation with the Government of Puerto Rico.

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FEDERAL EXPERIMENT STATION IN PUERTO RICO

of the

UNITED STATES DEPARTMENT OF AGRICULTURE

MAYAGUEZ, PUERTO RICO

CIRCULAR NO. 26

Washington, D. C. March 1947

MANILA GRASS FOR LAWNS

By NORMAN F. CHILDERS *assistant director, plant physiologist,* and DAVID G. WHITE *plant physiologist*

CONTENTS

INTRODUCTION

Manila grass, *Zoysia matrella* (L.) Merr., has been grown at the Federal Experiment Station in Puerto Rico for several years and has proved definitely superior to such lawn species as centipede grass (*Eremochloa ophiuroides* (Munro) Hack.), St. Augustine grass (*Stenotaphrum secundatum* (Walt.) Kuntze), Bermuda grass (*Cynodon dactylon* (L.) Pers.), Java grass (*Polytrias praemorsa* Hack.), and carpet grass (*Axonopus compressus* (Swartz) Beauv.). It is chiefly a tropical and subtropical grass, but it can be grown successfully as far north as Connecticut (*2*).[1] The blades are short, tough, narrow, numerous, pointed, and dark green (fig. 1). The important advantages of Manila grass are that it crowds out most weeds and other grasses, remains green during hot, dry weather, and appears to have no important insect enemies or diseases. The grass grows well under moderate shade even when in competition with the trees for water and nutrients (fig. 2). It also will grow satisfactorily under trees of dense shade, such as the mango, provided the lower limbs are pruned to 10 feet or more above the ground. The flower stalks appear mostly during the winter months in Puerto Rico, but being short they are not particularly objectionable and can be cut with a rotary lawn mower.

Well-established Manila grass forms a mat which feels like a thick Persian rug under foot. The blades will endure considerable punish-

[1] Italic numbers in parentheses refer to Literature Cited, p. 16.

FIGURE 1.—The blades of Manila grass are short, tough, narrow, numerous, pointed, and dark green. The short flower stalks appear mostly during winter months in Puerto Rico.

ment from wheel or foot wear, and, for this reason, the grass serves well on playgrounds, golf tees, and fairways, and on fields used for football, Army drill, or airplane runways. Unfortunately, this toughness makes the grass hard to cut with a hand lawn mower, but a rotary power mower cuts it with little difficulty.

As yet, there is no known commercial source of Manila grass seed in the Western Hemisphere. Hence, propagation is done entirely by sod blocks or sprigs, which are somewhat more tedious to handle and slow to establish as compared with seeding. A Manila grass lawn can be established in Puerto Rico in 9 to 20 months, depending upon the soil fertility, the water supply, and the original planting distance between the sod blocks. The blocks can be transplanted with a high percentage survival when the usual precautions are taken. Although no cost figures are available for comparison with other grasses, it has been generally observed at this station that Manila grass lawns once established are economical to maintain because of relatively less need for mowing and weeding (fig. 3).

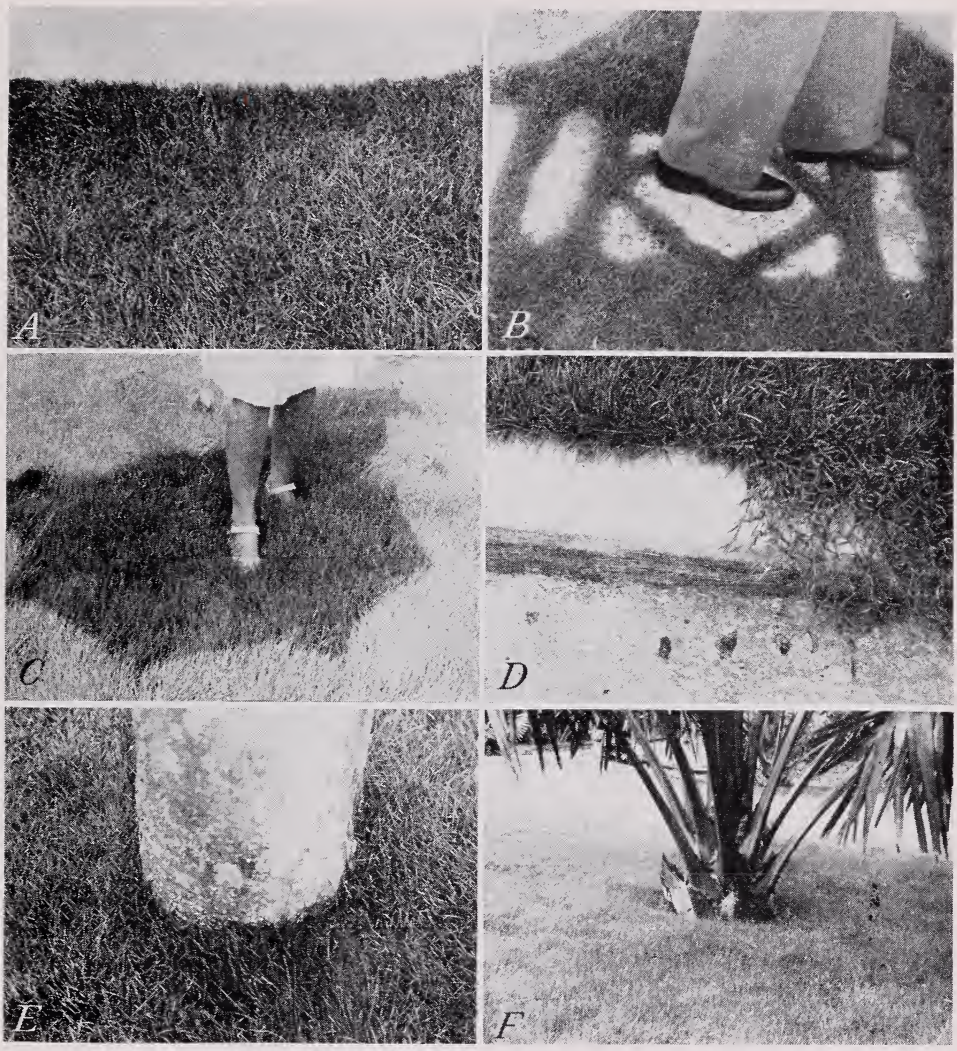

FIGURE 2.—Showing some merits of Manila grass: *A*, A thick mat of sod develops against walls and buildings if the grass receives some daily sunshine. *B*, In block walks it completely fills cracks where it continues to grow and remains green in spite of heavy traffic. *C*, The spongy mat of sod feels like a Persian rug under foot. *D*, Manila grass forms a compact regular border along hot concrete curbs and walks. (Note straggly stolons of Java grass on the right.) *E*, It grows snugly against trees, except in dense shade. *F*, The moderate to light shade of an umbrella palm has little or no effect on the thickness of sod. (Bermuda grass grows poorly under these conditions.)

BOTANY AND ADAPTATION

Although *Zoysia matrella* has received considerable publicity during the past few years (*1*, *2*, *5*, *6*, *7*), it is by no means a recent plant introduction. Table 1 gives a record [2] of introductions of this grass

[2] The authors appreciate the assistance of B. Y. Morrison and other members of the Division of Plant Exploration and Introduction, U. S. Department of Agriculture, for their aid in supplying information on the history and botany of *Zoysia matrella*.

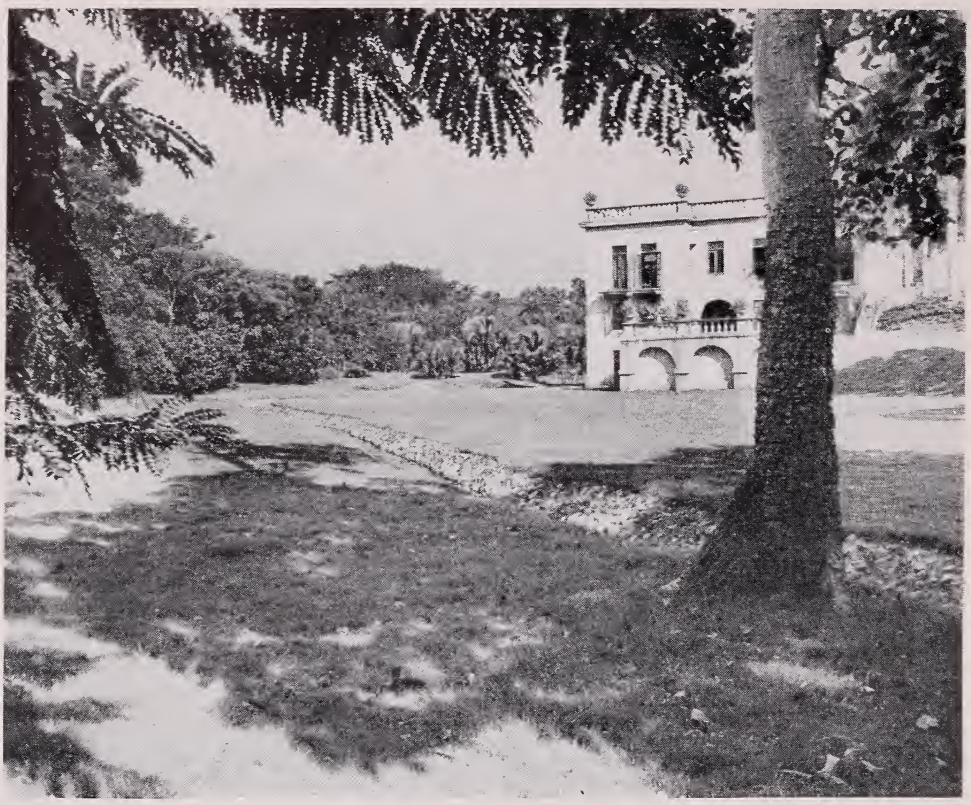

FIGURE 3.—Slow-growing Manila grass requires less mowing as compared with most lawn grasses. As a result of a labor and equipment shortage, this lawn at the Federal Experiment Station was not cut for 4 months during the semirainy season. It was weeded once. Although the blades are 2 to 5 inches long, the general appearance of the lawn is fairly good.

into the United States by the Division of Plant Exploration and Introduction, United States Department of Agriculture.

The following synonyms for *Zoysia matrella* have been used: *Agrostis matrella* L., *Z. pungens* Willd., *Osterdamia matrella* (L.) Kuntze, and *O. zoysia* Honda. The grass is now commonly referred to as zoysia, or Manila grass, and recently a seed company in the continental United States adopted the trade name "Flawn."

TABLE 1.—*Record of official introductions of Zoysia matrella (L.) Merr. into the United States*

Name and plant introduction number	Source	Material	Date
Osterdamia matrella—34657	Philippine Islands	Plants	December 1912.
Osterdamia matrella—42339	Sydney, New South Wales, Australia.	do	April 1916.
Osterdamia matrella—42678	Taihoku, Formosa	do	May 1916.
Osterdamia matrella—42839	Botanical Garden, Buitenzorg, Java.	do	June 1916.
Osterdamia matrella—43023	Yokohama, Japan (Yokohama Nursery Co.).	do	July 1916.
Zoysia matrella—107272	Dairen, South Manchuria	Seed	November 1934.
Zoysia matrella—107602	do	do	Do.

Zoysia matrella belongs to the family Poaceae. Merrill (*4, p. 85*) describes it as follows:

> A low, gregarious grass from rigid, wiry rootstocks, the branches rooting, sending up short, rather stiff, leafy, flowering branches 10 to 40 cm high. Leaves mostly spreading, 2 to 7 cm long, 2 to 4 mm wide. Spikes slender, solitary, purplish or green, 2 to 4 cm long. Spikelets about 3 mm long.

Under the synonym *Zoysia pungens* Willd., he gives other descriptive details of interest:

> A low, much-branched, rigid, erect, gregarious grass. Leaves subulate, sharply pointed. Spikelets small, ovoid, 1-flowered, somewhat crowded in erect, narrow spikes, jointed on and appressed to a stiff, notched, unjointed rachis, sessile, or shortly pedicelled. Glumes 2, the first empty, laterally compressed, shining, the second smaller, membranaceous, linear-oblong, obtuse. Palea hyaline, short, or none. Grain free within the glumes.

C. V. Piper (*9, p. 43*), when he introduced Manila grass into the United States from the Philippines in 1912 under the name *Osterdamia matrella* (L.) Kuntze, presented the following notes:

> This grass is abundant on or near the seashore in the Philippine Islands. Where closely clipped it makes a beautiful lawn. The Luneta in Manila some years ago was planted to Bermuda grass, but at the present time more than 90 percent of the grass is the Osterdamia, which has gradually displaced the Bermuda. . . . The grass has unusual promise as a lawn grass, especially near the Gulf coast and the Atlantic coast of Florida.

Maiden (*3, p. 112*) in 1889 emphasized the possible importance of Manila grass as a forage crop on dry coastal areas in Australia. He states that it is—

> A grass of considerable value on littoral swamps and dry flats near the sea . . . it is found sometimes forming a compact turf of dry land, and affording a large supply of succulent herbage for horses, cattle and sheep. Its value, however, in such localities, if bulkier grasses would grow there, must be comparatively little, as, from its close-growing habit, it chokes out all other species. It is evidently much relished by stock, and is worthy of introduction in sand-hill districts near the sea, or saline soil inland.

In Connecticut Manila grass has been reported [3] to turn a light brown with the first autumn frost and not to regain its greenness until late May. The commonly grown northern grasses turn green earlier in the spring, although often becoming brown during the hot, dry summer weather. Manila grass thus has the advantage of remaining green throughout the summer.

Farther south below a line from Atlanta, Ga., to Dallas, Tex., this grass is one of the last to be affected by frosts in the fall, when it turns a dull grayish green for about 3 months in winter. It is the first to regain color in the spring and remains green 9 to 10 months of the year in central Alabama, which is a much longer period than for Bermuda grass in that area (*6*). In southern Florida and Texas, as in Puerto Rico, Manila grass is green the year round. According to Sturkie and Fisher (*8, pp. 7–8*), "It is probably the best grass that has been found for Alabama provided the lawn is well cared for. So far as is known it is suited for use in all parts of the State." Baker (*2*) reports that it grows well under oaks, black walnut, Chinese elm, Eucalyptus, hackberry, royal poinciana, butterwood, and palms, provided the lower limbs are 10 feet or more above the ground and

[3] In correspondence from C. W. Baker, 1945.

adequate fertilizer is applied under the trees. Manila grass survives shade somewhat better in southern United States than in northern areas.

The first introduction of Manila grass into Puerto Rico was made by the Federal Experiment Station in 1936 when a ½ square foot of sod was obtained from the Florida Agricultural Experiment Station. From this original introduction, it has been distributed and redistributed on the station grounds until it now covers about 5 acres. Also, numerous sod blocks from this stock have been disseminated for trial purposes throughout Puerto Rico and to neighboring countries.

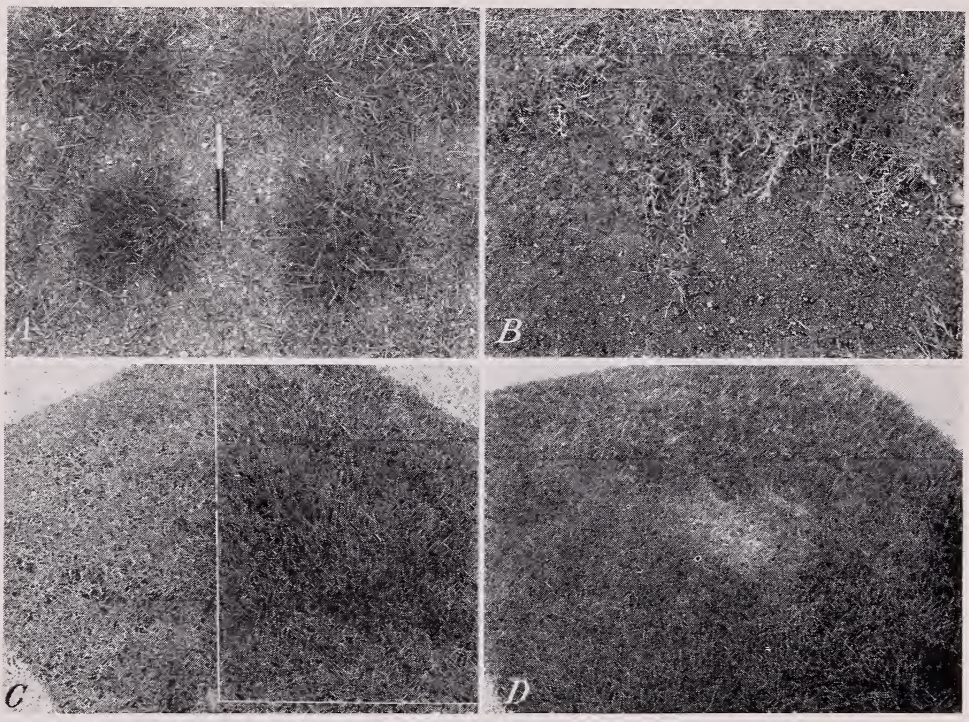

FIGURE 4.—*A*, Where a complete fertilizer and manure or other organic matter have been added, Manila grass grows satisfactorily in sandy soils. *B*, It spreads into other grasses and vacant areas by means of short-noded stolons. *C*, Grass on the right received nitrogen fertilizer 3 months before the picture was taken; that on the left, no nitrogen. Grass is growing on excavated clay subsoil. *D*, Finely ground fertilizer should be used; lumps cause burned spots.

During the rainy season and under fertile soil conditions in Puerto Rico, Manila grass reaches a height of 6 to 8 inches when it is not mowed. With moderate rainfall and fertilization, however, it generally grows to only 3 or 4 inches. It flowers and fruits during the short-day, dry season from November to May (fig. 1). The grass produces many stolons, as shown in figure 4, *A* and *B*, which arise from below the crown and grow just under or on the soil surface. This system of growth enables it to surround, intermingle with, and "undermine" weeds and other grasses. It does not produce stolons which grow upward and give the lawn a general scraggly appearance, as occurs with Bermuda grass. Manila grass stolons have numerous closely spaced nodes from which many roots arise that penetrate the

surface soil, mainly during the rainy season. With the advent of the dry season this grass then is in a position to compete heavily with other grasses and weeds for water, and it is usually predominant because of its ability to better withstand drought periods. This seems to be especially true if adequate fertilizer has been applied during the rainy season to give the grass a vigorous start.

SOILS AND PREPARATION

Manila grass grows on a wide range of soils from sandy coastal types (fig. 4, *A*) to the heavy adobe clays. In trials at the station the grass has grown satisfactorily on excavated clay subsoils provided sufficient fertilizer, mainly nitrogen, was applied (fig. 4, *C*). Without this fertilizer the blades were short, yellowish green, thin, and more or less prostrate. The grass is sensitive to very acid soils (*8*) and grows poorly at pH 4.5 or lower. Best growth is obtained on soil with a pH between 5.5 and 6.5; its growth is mediocre on alkaline soils where Bermuda grass may give it considerable competition. On very acid soils the pH can be raised one unit by mixing about 1 pound of agricultural limestone with the upper 3 or 4 inches of soil over a lawn area of 20 square feet. If the soil pH is above 7.0, it can be lowered by mixing 1 pound of sulfate of aluminum, or alum, and ½ pound of finely powdered sulfur with the upper layer of each square yard of lawn and, in following springs, by broadcasting ½ pound of sulfur over each square yard.

In preparing for the planting of a lawn it is generally recommended that the soil be turned and raked or harrowed to form a fine textured bed, after which fertilizer is worked into the soil and the sod blocks planted. This practice was followed for Manila grass with good results on one of the lawns of the station, as shown on the front cover of this circular. However, in subsequent plantings good results have been obtained also by scraping the surface clean of weeds and grasses with a sharp hoe, then planting the sod blocks and fertilizing. The latter method is less troublesome and more economical. It is important, however, that any shifting of the soil be done in advance of planting in order that the lawn will have a smooth appearance, with good top drainage (see fig. 5). Although Manila grass will tolerate an abundance of rainfall and survive poorly drained areas surprisingly well, it is good precaution to provide persistently soggy areas with tile drainage. This can be done by using 4-inch tile drains spaced 25 feet apart and laid 1½ to 2 feet deep, with a fall of 3 inches for every 50 feet.

When planting on sandy soil it is desirable to use a wheelbarrowful of rotted leaves and/or rotted manure for each 100 square feet of lawn, mixing it with the upper 3 or 4 inches of soil. This procedure is also effective in obtaining a quicker coverage of grass on heavy soils. For sandy soils where phosphorus and potassium are likely to be deficient, a complete fertilizer such as 10–10–5 at the rate of 10 pounds per 100 square feet is better than a fertilizer containing only nitrogen (see fig. 4, *A*). Nitrogen fertilizer applied at 0.5 pound per 100 square feet is usually all that is needed for heavy or loamy soils (see fig. 4, *C*).

After the soil has been prepared, the fertilizer spread, and the sod blocks set, it is well to sprinkle the soil with a garden hose to

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FIGURE 5.—Planting a Manila grass lawn at the Federal Experiment Station in Puerto Rico. Shallow pits for 2-inch sod clumps are dug with a grubbing hoe; clumps are tamped in place with the same instrument, watered lightly, rolled, and watered heavily. Note the 1- to 2-percent grade which provides surface drainage from road on the right to pond on the left.

dissolve the fertilizer immediately. This prevents the possibility of burning the grass in areas where the chemical salts may have fallen in concentrated amounts (fig. 4, *D*). It also provides needed water to the newly planted grass.

PLANTING

The time for planting Manila grass in the Tropics and subtropics is preferably at the beginning of the rainy season. This gives the grass opportunity to become well established before the dry season begins. Plantings can be made successfully during the dry season, but watering is required at weekly or biweekly intervals. In the southern United States, where heavy winter freezes are not a factor, fall planting is preferred (*8*) because the grass receives the benefit of the fall and winter rains, makes some root growth, and is ready for immediate growth in early spring. If spring planting is necessary, the sod blocks or sprigs are set in time to receive about 2 months of rainy weather before the dry season. Inasmuch as this grass will tolerate more heat than most grasses, the main factor involved in obtaining a good "take" is the provision of adequate moisture and fertilizer.

Manila grass is propagated almost entirely by springs or 1½- to 2-inch blocks of sod (fig. 6). As yet, no seed is commercially available because it is scarce and germinates poorly. An experiment at this station indicated that fruiting of this grass is associated with the day

FIGURE 6.—Manila grass is propagated by sod blocks (left) or by sprigs (right). It requires about twice as long to establish a lawn with sprigs, but more lawn can be planted from a given amount of propagating material.

length. When the days were artificially lengthened to 16 hours by using a Mazda lamp, few seed stalks were produced. However, if the light periods were shortened to 8 to 9 hours, good fruiting occurred but growth was limited. Little or no fruiting occurs in summer in Puerto Rico when the length of day is about 13 hours, but there is considerable fruiting in winter with 11 to 12 hours of daylight. In addition to the effect of day length on fruiting, it is of interest to note that more fruiting has been observed on soils with a moderate to low nitrogen content just preceding and during the fruiting period. Fruiting also has been reported in southern Florida in winter (*2*).

The percentage germination from seed obtained from the station grounds has been less than 1 percent under field conditions, and this germination was slow. Higher percentages of germination have been obtained in the laboratory by special acid and base treatments but, as yet, no satisfactory method can be recommended for establishing a Manila grass lawn from seed. Porter [4] states that the poor germination can be explained in part by the fact that "the lemma and palea of *Zoysia matrella* seed are very hard and it is probably difficult for moisture to enter and for proper interchange of gases to occur."

Several continental seed and nursery companies are offering Manila grass sod for sale. It is sold in units of 1 square foot or 1 square yard, washed free of soil, and packed moist with sphagnum moss or similar material. Upon arrival the sod should be removed from the package and placed in the shade, kept moist, and planted as soon as possible. For best results the lawn should be prepared prior to arrival of the sod. It is difficult to give exact figures on the amount

[4] In correspondence from R. H. Porter, Iowa State College, Ames, Iowa, 1945.

of sod required for a given area of lawn. In general, 1 square yard of sod will cover about 36 square yards of lawn, when 2-inch squares of sod are set 12 inches apart both ways. If small sprigs are used, 1 square yard of sod should cover 350 to 400 square yards of lawn when the sprigs are spaced 12 inches apart on the square.

When the cost of nursery sod for establishing large lawns is prohibitive, smaller quantities of 1 or 2 square yards of sod can be purchased and planted in the back yard. From this original quantity the sod later can be distributed and redistributed (fig. 7) until the entire lawn is covered.

FIGURE 7.—Manila grass can be redistributed to cover additional lawn area. With a flat spade the sod is cut into large blocks and rolled up, then moved to a shady spot where it is cut into small blocks with a machete or similar tool.

Sod blocks spaced 12 inches apart both ways require about 16 to 20 months in Puerto Rico to establish a lawn. If adequate sod is available and the blocks are spaced 6 inches apart (fig. 8), a smooth lawn develops within only 9 to 12 months. If the lawn is given close attention in watering, weeding (see p. 11), and fertilization, the clumps of sod will coalesce more rapidly.

After planting an area it should be rolled once or twice to firm the sod blocks. For the next 2 or 3 months the grass must be watered once or twice a week in periods when there are no rains. It is best to soak the soil to a depth of 2 to 4 inches at each watering because light daily waterings are actually harmful, causing the roots to develop near the soil surface where they are subject to drought damage.

Occasionally it may be necessary to plant Manila grass on inclines where washing is likely to occur. One-inch strips of sod planted a foot apart on the contour will aid in checking erosion. The use of straw between the strips also is effective in holding the soil.

MAINTENANCE AND CARE

Mowing.—It is necessary to mow regularly in order to maintain a smooth trim lawn. Grass should be allowed to grow to a height of about 3 inches, then mowed with the cutter bar set at about 1½ to 2 inches above ground. This permits the grass to spread and fill vacant spots and promotes better root development. Manila grass under this management becomes spongy and ruglike. When mowing is done regularly, the short clippings can be allowed to sift among the blades and furnish a mulch which is highly beneficial in conserving moisture and providing organic matter. The short clippings can be left as they fall or they can be brushed into the grass with a broom or flexible rake. Long clippings, however, might well be removed by raking or by using a canvas grass catcher attached to the mower.

Weeding.—When Manila grass is set with blocks or sprigs, little weeding should be practiced except to remove the very large-leaved plants or fast-growing odd grasses. Too much pulling of weeds hinders growth of the Manila grass by tearing the rooting runners away from the soil. While the grass is becoming established, it is important to mow regularly, however, to prevent other vegetation from overshadowing it and giving too much competition. After the clumps have coalesced, it may be necessary to go over the lawn thoroughly once or twice a year for 2 years to remove occasional weeds. If the lawn is well fertilized, however, Manila grass will form such a tight sod that few weeds compete with it.

A plant hormone known as 2,4-dichlorophenoxyacetic acid has been tested on the station grounds for killing weeds that arise between the Manila grass clumps shortly after planting (see fig. 9). The chemical is applied as a spray, preferably when the weeds are 3 to 6 inches high. It is generally not harmful to grasses but effective in killing both tops and roots of many broad-leaved weeds, including the tropical pest cohitre (*Commelina diffusa* Burm. f.).

The weed killer can be applied shortly after the sod clumps are planted or several months later. A 0.10- to 0.20-percent spray is prepared according to the manufacturer's recommendation.[5] It must be applied evenly over the area so that all leaves are covered completely but not excessively. A knapsack sprayer is convenient for medium-sized lawns, whereas a small power sprayer may be used for larger lawns (fig. 10). Most weeds turn yellowish within 4 to 7 days after the spray is applied, and the majority die within 3 weeks. A second application 3 to 4 weeks after the first may be necessary to eliminate weeds which had not reached the soil surface at the time the first spray was applied. The lawn will assume a yellowish appearance for a while until the weeds have decomposed. It is evident from experience at this station that a Manila grass lawn can be established quicker by using a combination of regular fertilization with one or two applications of weed killer, starting one or two months after planting the sod blocks.

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[5] For additional information consult your Government or State research and extension service.

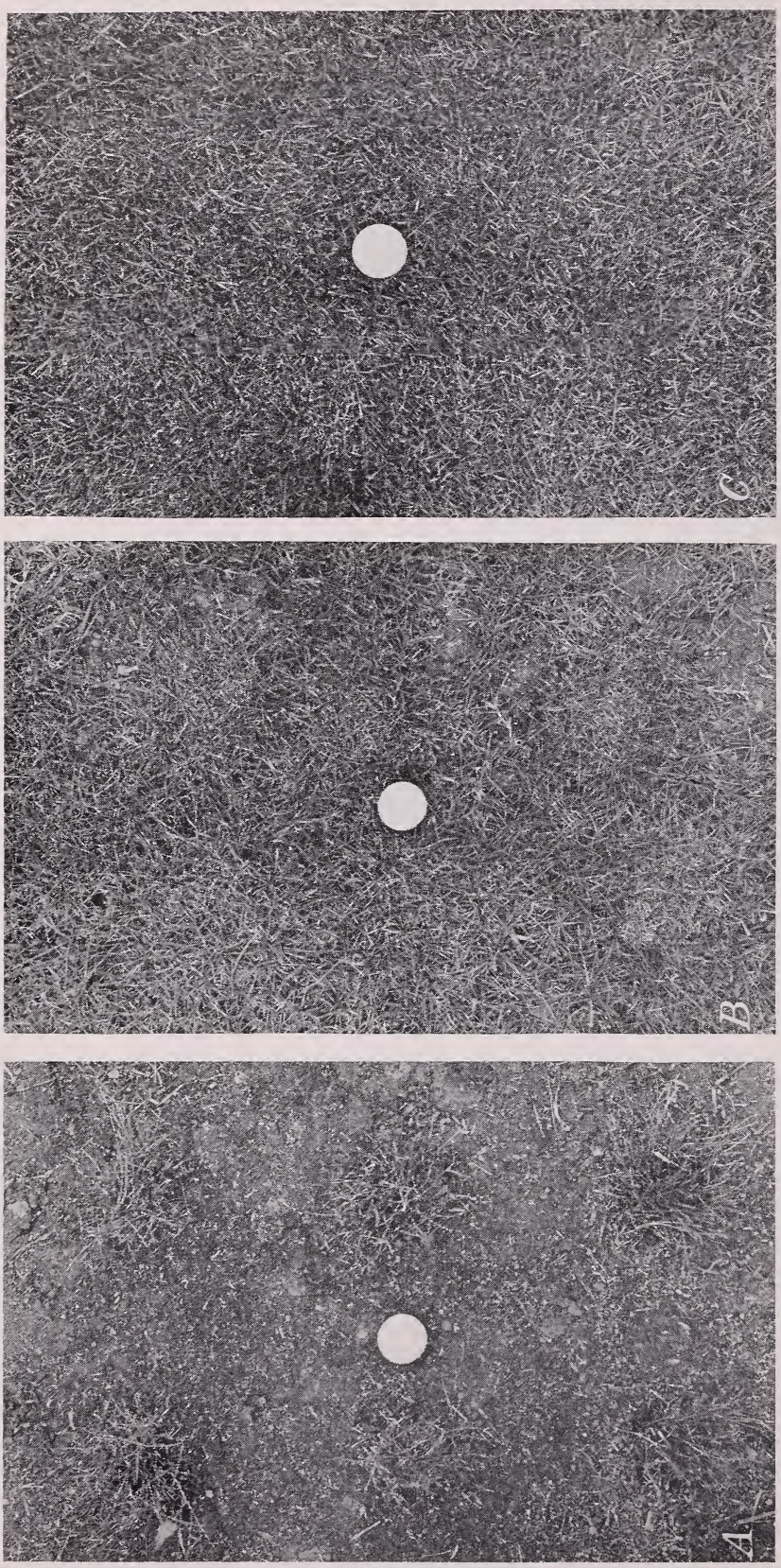

FIGURE 8.—The photographs show (*A*) the 2-inch blocks of Manila grass sod planted 6 inches apart, (*B*) the clumps merging together 6 months later, and (*C*) the thick mat of sod 14 months after planting.

FIGURE 9.—A hormone weed killer, 2,4-dichlorophenoxyacetic acid, applied as a spray is effective in eliminating many weeds while the Manila grass clumps are becoming established. Upper photo shows 5-month-old clumps treated with 2,4-D about 2 months after planting; lower photo shows untreated neighboring plot overgrown with weeds. Neither plot received hand weeding.

FIGURE 10.—A 50-gallon power sprayer is employed at the Federal Experiment Station to cover the Manila grass lawns with 2,4-D weed killer. Smaller power or hand-operated sprayers can be used with relatively more labor. Special precautions are necessary to prevent the chemical from drifting onto shrubs, trees, and other permanent plantings.

Fertilization—*Poor lawns are largely a result of improper or no fertilization.*—Frequent fertilization of Manila grass is important during the first year in order to encourage a quick stand and enable the grass to crowd out undesirable grasses and weeds. Monthly or bimonthly applications are recommended using about 1 pound per 100 square feet of a 6–8–7 or 10–10–5 or similar complete fertilizer. As stated previously, nitrogen is the element which generally stimulates most response in growth of the grass, especially on loam or clay soils. Nitrogen alone can be applied as nitrate of soda, sulfate of ammonia, or ammonium nitrate at the rate of about 0.5 pound per 100 square feet. It is important to apply the fertilizer immediately before a rain to prevent burning, or, if there is no rain, to thoroughly wash the fertilizer from the leaf blades with a garden hose. The fertilizer may be applied to a lawn when the blades are dry provided a broom is used to brush the chemical onto the soil surface. Experience at this station, however, has shown that Manila grass is highly resistant to leaf burning by fertilizers, and such precaution may not be entirely necessary for this grass, provided the fertilizer is well pulverized (see fig. 4, *D*). The fertilizer can be spread by hand or by a two-wheel special lawn applicator, the latter of which gives a more even distribu-

tion. If application is made by hand, the fertilizer should be mixed half and half with fine sand or pulverized dry soil and care taken to systematically cover the lawn for even distribution. Otherwise, some areas may be overfertilized while other areas receive none, resulting in burned spots or mottled light and dark-green areas. After the lawn has become established, it is important to study the grass color and apply only enough fertilizer to maintain a medium-green color and moderate growth. Too much fertilizer results in rapid growth and, therefore, requires more labor in mowing, although the grass is somewhat more tender to cut under these conditions. Excessive nitrogen fertilization may result in the appearance of numerous clumps of nutgrass from dormant underground stolons, which give the lawn an uneven appearance. However, these clumps can be reduced by one or two applications of the weed killer recommended previously.

A double application of fertilizer may be necessary under trees in order to provide adequate nutrients for both grass and trees.

Watering.—After a Manila grass lawn is well established, there is little need for watering even during dry periods. The lawn shown on the front cover of this circular withstood a 7-month drought, with no harmful effects during 1943–44, 2 years after it was planted. During this period, in the absence of irrigation, the grass assumed a slight tan cast toward the end of the dry period but became a rich green 1 week after the first heavy rain.

SODDING OLD LAWNS WITH MANILA GRASS

It may be desirable to convert an old lawn of Bermuda or similar grass to a Manila grass sod. This can be done with sod blocks of Manila grass which are at least 2 inches square (*8*); sprigs are not recommended for this purpose. Holes are dug in the existing sod about 12 inches apart both ways, and the Manila grass plugs are set at their previous depth and packed with extra soil. Fertilization at 1- or 2-month intervals is important for the first few months. It takes 2 or 3 years for the Manila grass to fill in, after which it is necessary to weed out clumps of the old grass.

INSECTS AND DISEASES

In the continental United States Manila grass is reported to be immune to the common lawn diseases and insect pests (*2*), including the chinch bug and Japanese beetle. In Puerto Rico only one minor insect and a disease have been noted in 10 years of experience with the grass. The insect is the fall armyworm (*Laphygma frugiperda* (A. & S.)), which leaves only the dry white epidermis at the tips of scattered blades (fig. 2, *D*). The injury was apparent for a period of about 2 months in 1945, beginning in September. The unidentified disease appeared in scattered reddish-tan patches about the size of a saucer or smaller. Only the upper portion of the blades was injured, and the roots soon regenerated new foliage. Both types of injury were barely noticeable on well-mowed areas.

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POINTERS ON MANILA GRASS

1. Properly managed Manila grass is one of the best and most attractive lawn grasses for the Tropics and subtropics. It can be grown successfully in the continental United States, especially in the South.
2. The grass is slow growing, tough, dark green, thick, spongy, free from straggly runners, and tolerant of a wide range of soil types. It thrives in shade better than most lawn grasses and is resistant to drought, fertilizer burning, and important insect pests and diseases.
3. Manila grass is hard to cut with a hand lawn mower, but is cut with little difficulty with a rotary power mower. Relatively few mowings per season are required.
4. Because of the toughness of Manila grass, it will withstand considerable wheel and foot wear on golf tees and fairways, playgrounds, roadways, cemeteries, walks, and fields used for football, Army drill, and airplane runways.
5. As yet, no commercial seed is available in the Western Hemisphere; it is propagated entirely by sprigs or small sod blocks.
6. In Puerto Rico from 9 to 20 months are required to establish a lawn, depending upon planting distance and growing conditions; in temperate zones 1½ to 2 years are required.
7. Manila grass must be fertilized regularly to maintain its beauty.
8. Once established the grass is permanent and relatively free from weeds. One or two applications of a chemical weed killer 2 to 3 months after the grass is planted will reduce or eliminate most weeds from the lawn, including such pests as nutgrass and cohitre.

U. S. GOVERNMENT PRINTING OFFICE: 1947